# HEURISTIC SEARCH FOR FAST ROBOTIC MANIPULATION PLANNING

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Manipulation Planning

- **Planning for autonomous robot applications** - cooking, organizing a warehouse, disaster recovery, etc.

- **Task planning** - planning for abstract sequences of robot actions (pick, place, look, open, etc.)

- **Motion planning** - planning for specific motor movements
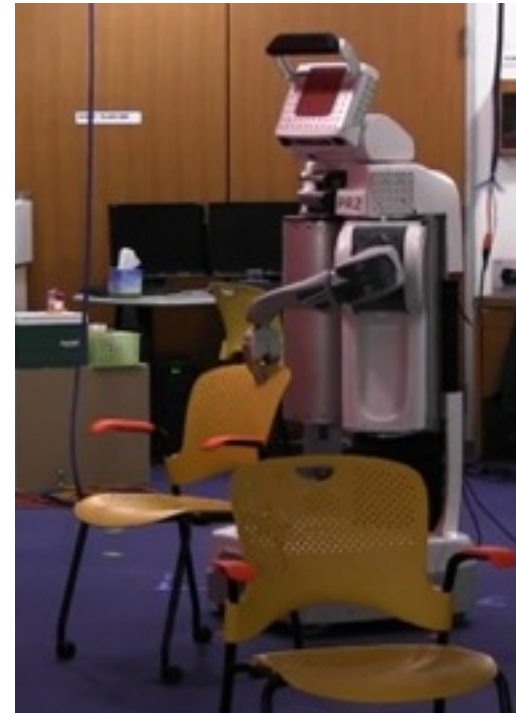
Swap Green and Blue Blocks
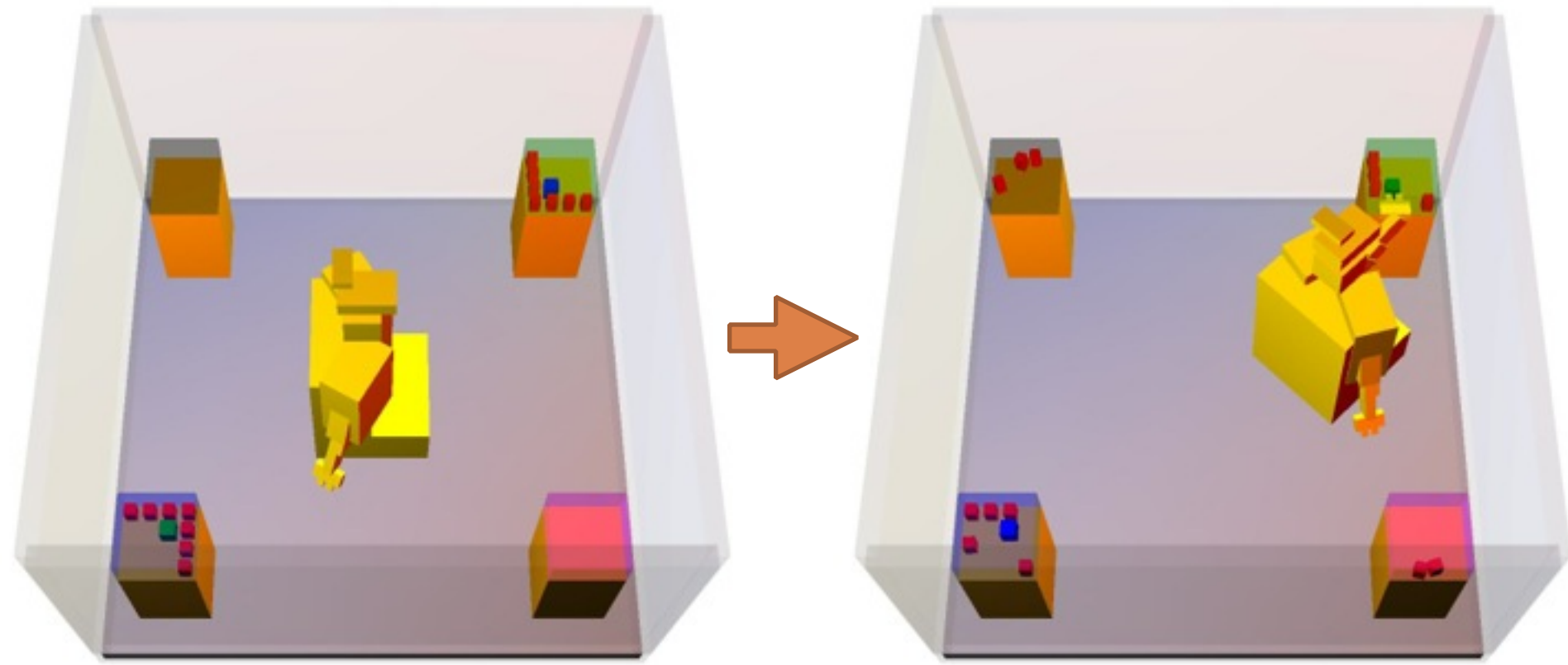
FFRob

- **Modern planners take minutes to hours to solve**

- **Result from discrete planning** - powerful heuristic guesses are key to good empirical performance

- **State of the art** - independent task and motion planning. Only uses a discrete task heuristic

- **FFRob** - integrated task and motion planning. Uses a combined task and motion heuristic

Swap Green and Blue Blocks
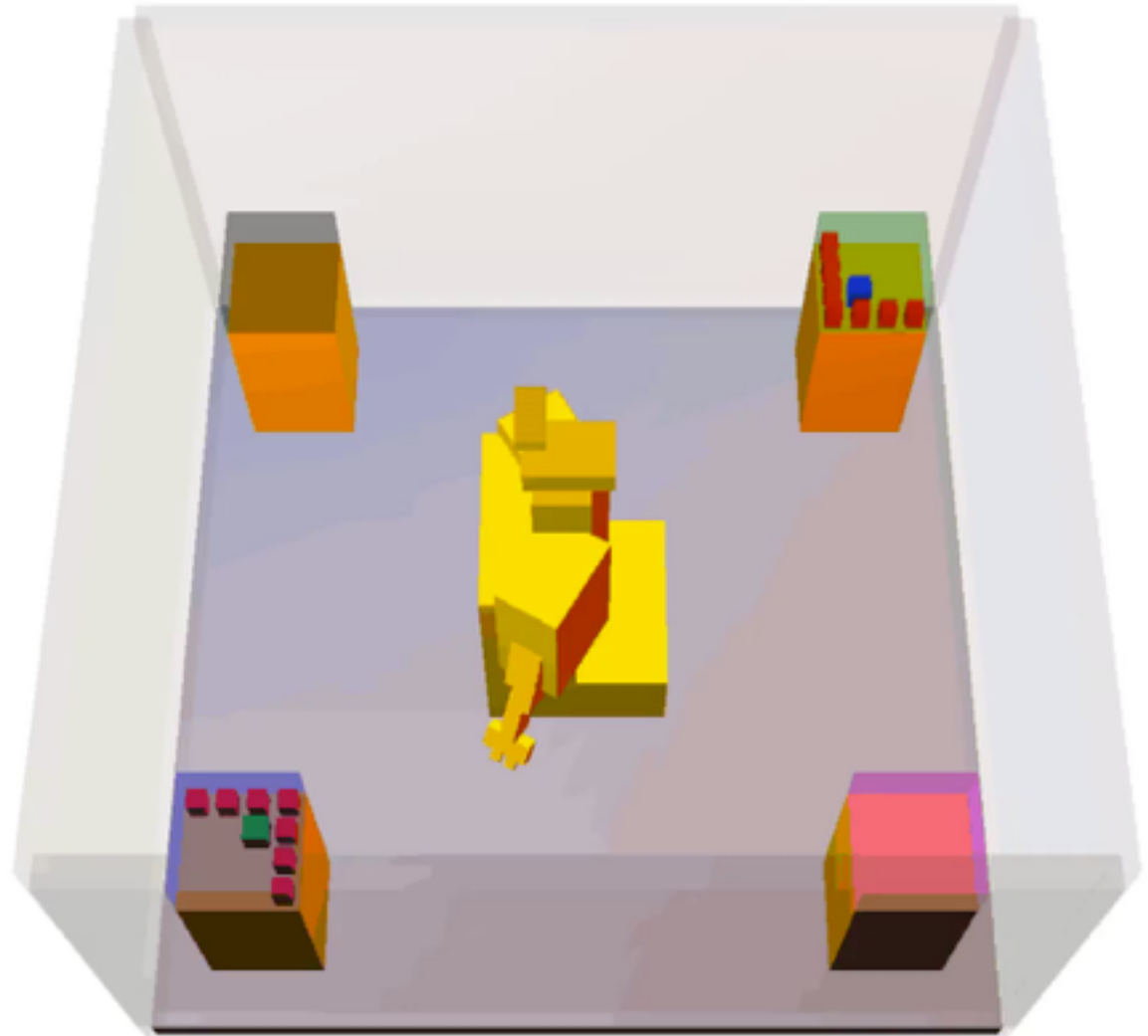

Task 4

Plan length
9 picks
9 places
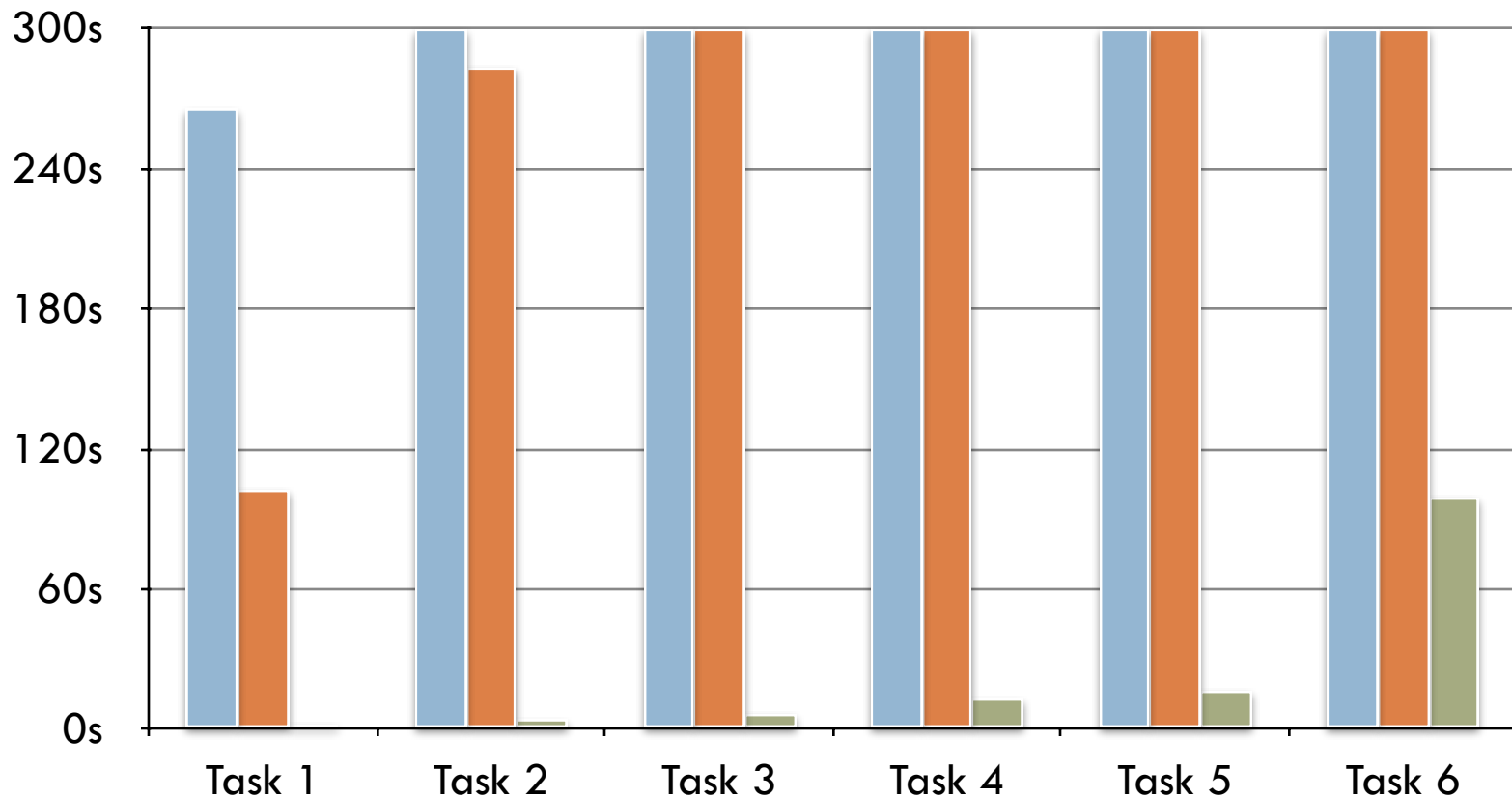493 movements

Planing resources
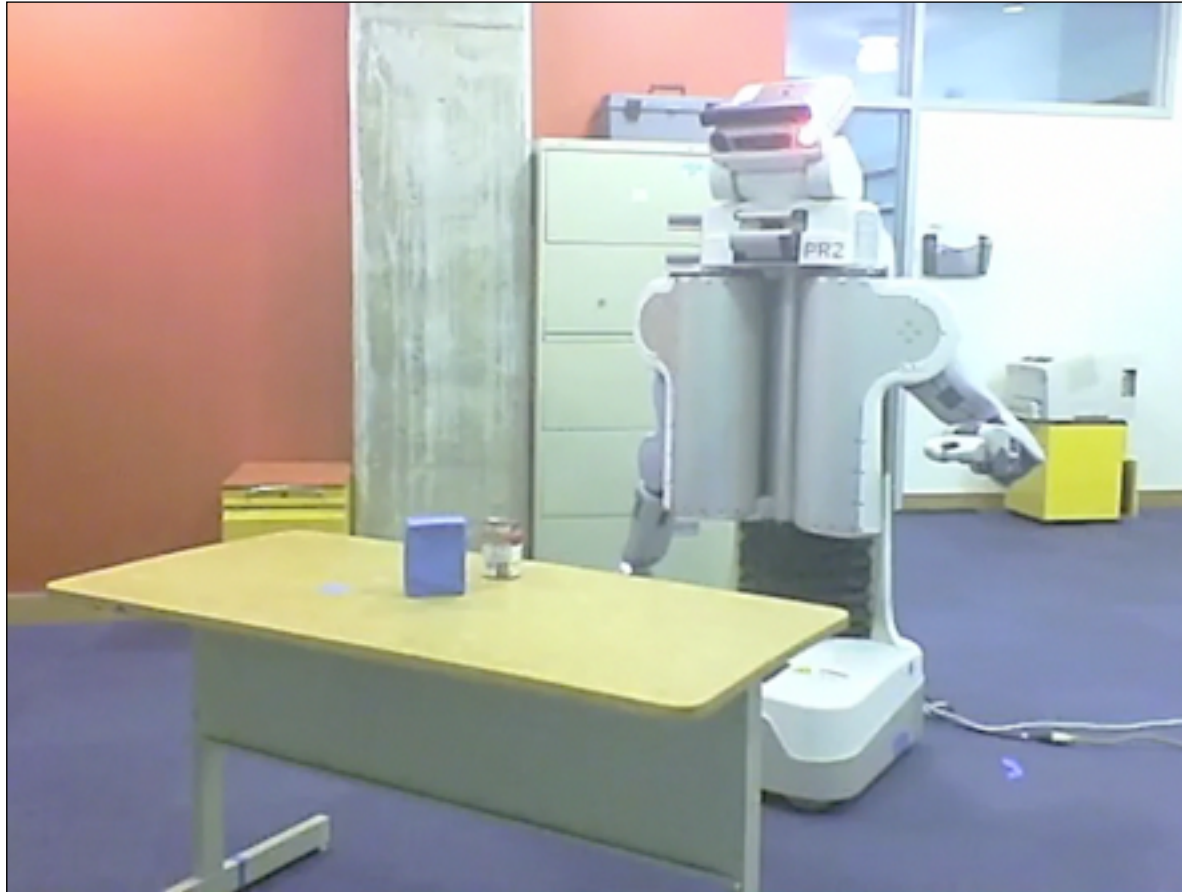24s preprocessing
15s search
74 states explored

Median Plan Time

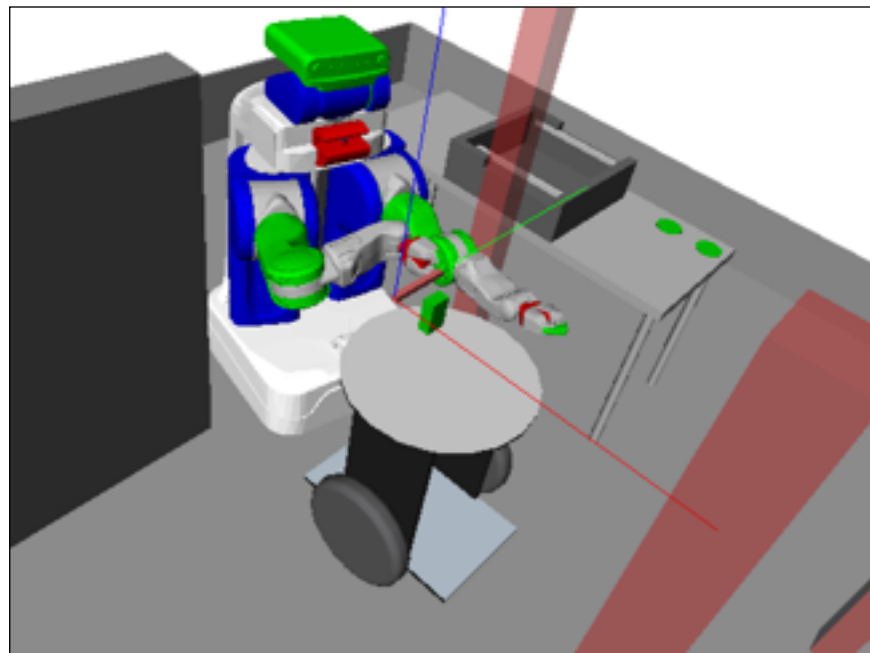
300s Timeout — Uninformed, State of the art, FFRob
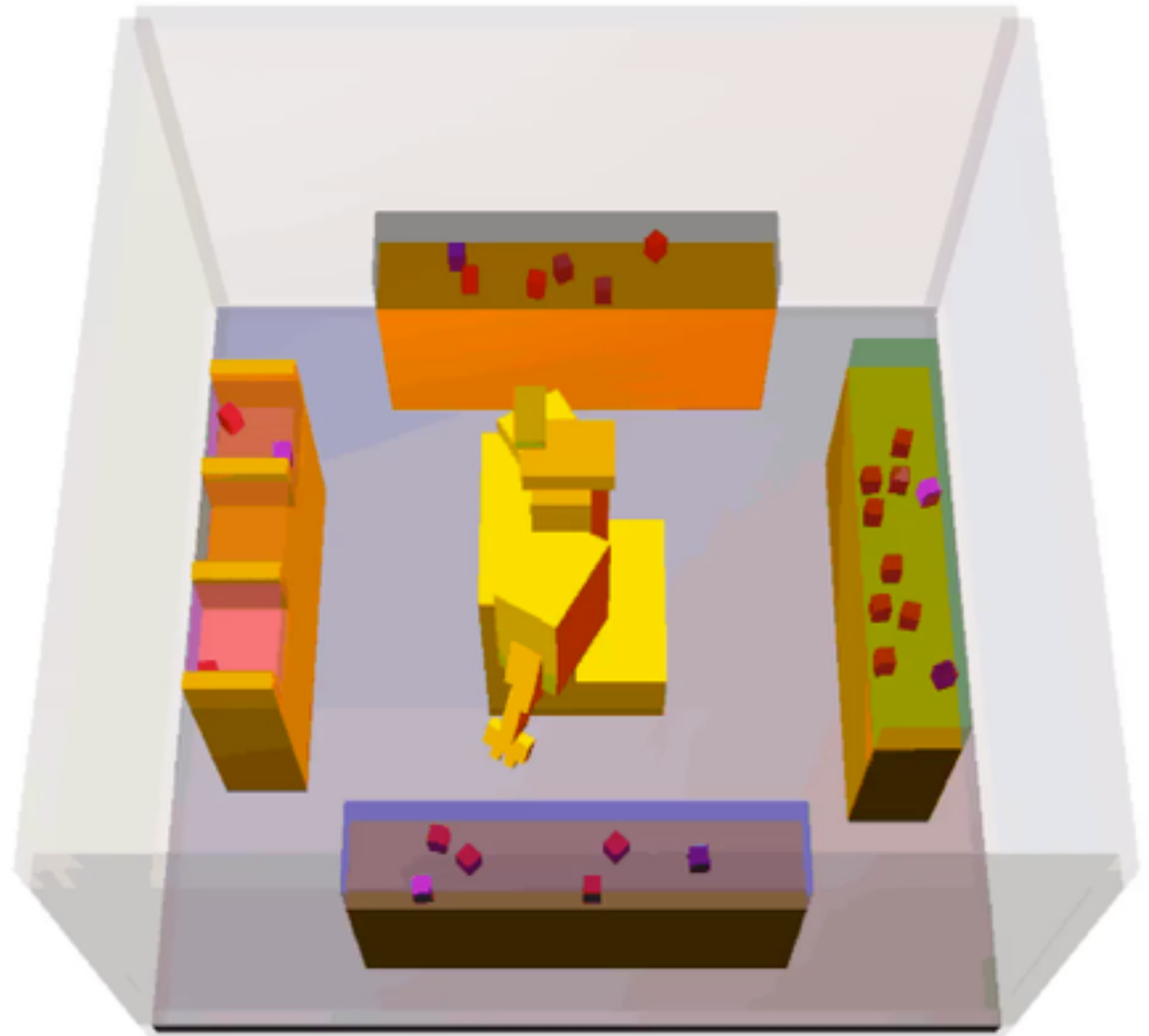
Move Blue Box

Current Work

- Multivariable continuous planning generalization
- Other manipulations - pushing, pulling, turning, etc
- Long horizon task and motion planning problems
- Uncertainty and partial observability

Thank you!

Task 6

Questions?

Cabinet Manipulation

Move Green to Place Purple

Plan length
3 picks
3 places
226 movements

Planing resources
26s preprocessing
3s search
26 states explored